

What is claimed is:

1. An apparatus for infusing a medicating agent to a specific desired location such as tumor, within a patient's body, comprising:
  - a pouch having one or more chambers;
  - at least one medicating agent disposed in said one or more chambers; and
  - at least one piezoelectric pump configured to transfer said at least one medicating agent to said patient.
2. The apparatus of claim 1 further comprising control logic to control said at least one piezoelectric valve to provide proper dosing and scheduling of said medicating agent.
3. The apparatus of claim 1 further comprising control logic to control said at least one piezoelectric valve to provide for infusing said medicating agent to a specific desired location such as tumor, within a patient's body, comprising:
4. The apparatus of claim 1 further comprising control logic to control said at least one piezoelectric valve to provide for regulating, controlling, and modulating a combination therapy of cytokine and chemotherapeutic agents for the purpose of tumor elimination.
5. The apparatus of claim 1 further comprising control logic to control said at least one piezoelectric valve to administer less than the maximum tolerated dose of said medicating agent.
6. The apparatus of claim 1, said at least one medicating agent comprising at least one of, a cytotoxic agent, a pleiotrophic agent, and an agent having both cytotoxic and pleiotrophic properties.
7. The apparatus of claim 1 further comprising control logic to control said at least one piezoelectric valve, said control logic configured to change a sequence of events, such as

5 release of various agents on a specific schedule and dose due to the innate capability of the apparatus to receive commands via communication links, thereby offering a treatment change in mid-stream by transmitting program codes, which instruct the microcontroller to enhance one process or another

10 8. The apparatus of claim 1 further comprising control logic to control said at least one piezoelectric valve to regulate and schedule a dose of said medicating agent.

9. The apparatus of claim 1 further comprising control logic to control said at least one piezoelectric valve to provide combination therapy for solid tumor

15 10. The apparatus of claim 1 further comprising control logic to control said at least one piezoelectric valve to provide selective treatment comprising at least one of: Interferon  $\alpha$  and 5 fluorouracil and calcium liucovorin combination of dacarbazine, BCNU, cisplatin, and tonoxifen followed by interferon  $\alpha$  and IL-2

20 11. The apparatus of claim 1 further comprising a plurality of chambers.

12. The apparatus of claim 1 further comprising control logic to control said at least one piezoelectric valve to control release of said medicating agent based on tumor-specific behavior

25 13. The apparatus of claim 1 further comprising sensors to monitor at least one of a temperature, a pH level, and a pressure in a tumor region.

30 14. The apparatus of claim 1 further comprising sensors and control logic to monitor biometric measures and indications of the behavior of a tumor and a treatment history.

15. The apparatus of claim 1 further comprising a sensor to measure pH.

35 16. The apparatus of claim 1 further comprising pressure and temperature sensors

- 5 17. The apparatus of claim 1 further comprising a processor and software module configured to differentiate malignant versus normal cells due to lack of specificity of the cancer cell.
- 10 18. The apparatus of claim 1 further configured to measure pressure between a tumor site and the pouch
19. The apparatus of claim 1 further comprising logic to administer said medicating agent on schedule as well as duration and sequence.
- 15 20. The apparatus of claim 1 configured to deliver said medicating agent by the use of electronic control of said piezoelectric pump.
21. The apparatus of claim 1 further configured to provide infusion of biological response modifiers in combination with chemotherapeutic agents.
- 20 22. The apparatus of claim 1 wherein said piezoelectric pump comprises a piezoelectric layer-wise pump and valve.
23. The apparatus of claim 1 further comprising an electronic control module to control said piezoelectric pump to provide timed release of said medicating agent.
- 25 24. The apparatus of claim 1 further comprising a software module to control said piezoelectric pump to provide an implantable apparatus containing electronics and a reservoir which is biodegradable and is of multi-chamber architecture
- 30 25. The apparatus of claim 1 further comprising a software module to control said piezoelectric pump to provide for controlled-delivery of.
- 35 26. The apparatus of claim 1 further supports controlled delivery of chemotherapeutic agents and BRMs which is achieved by the use of an electronic timer and a microcontroller

- 5 27. The apparatus of claim 1 further comprising a software module to control said piezoelectric pump to provide an apparatus having multiple chambers, providing the clinician the ability to deliver a set of multiple medicating agents to the tumor site
- 10 28. The apparatus of claim 1 further comprising a software module to control said piezoelectric pump to provide an irrigation action which allows for the bioavailability of said medicating agent.
- 15 29. The apparatus of claim 1 further comprising a software module to control said piezoelectric pump to provide an irrigation action for delivery of said medicating agent to provide improved penetration and treatment of tumors
- 20 30. The apparatus of claim 1 further comprising a software module to control said piezoelectric pump to provide an irrigation action for delivery of said medicating agent to refractory nature of a tumor by enhancing angiogenetic action at the tumor site.
31. The apparatus of claim 1 further comprising a software module to control said piezoelectric pump to provide an active pump and valve to provide control of dosage and timing of the medicating agent.
- 25 32. The apparatus of claim 1 further comprising a communications link.
33. The apparatus of claim 1 further comprising a bi-directional communications link.
- 30 34. The apparatus of claim 1 further comprising a digital communications link.
- 35 35. The apparatus of claim 1 further comprising an RF communications link.
36. The apparatus of claim 1 further comprising a communications link to provide control instructions to said piezoelectric valve..

- 5 37. The apparatus of claim 1, piezoelectric pump comprising a pressure generator to develop pressure along an axial path of an electrostatic valve
38. The apparatus of claim 1 comprising a scaffolding structure to reduce clogging of the piezoelectric pump due to increased flow of the medicating agent
- 10 39. The apparatus of claim 1 further comprising a pressure monitor.
40. The apparatus of claim 1 further comprising a bidirectional communication link configured to provide wireless communication to an external user.
- 15 41. The apparatus of claim 1 further comprising a control module to provide a voltage control of said piezoelectric pump.
42. The apparatus of claim 1, siad piezoelectric pump comprising a bimorph geometry.
- 20 43. The apparatus of claim 1 further comprising control logic to control a rate at which the medicating agent is delivered.
44. The apparatus of claim 1 further supports system where a continuous monitoring and reporting of biological response parameters are maintained in the resident memory of the system
- 25 45. The apparatus of claim 1 further comprising a control system to control delivery of said medicating agent on a case-specific basis using a pre-programmed dosing schedule.
- 30 46. The apparatus of claim 1 further comprising a control system to control delivery of said medicating agent based on look-up-tables.
47. The apparatus of claim 1 further comprising a control system to control delivery of said medicating agent in real time.
- 35

- 5        48. The apparatus of claim 1 wherein said pump comprises a valve, said apparatus further  
         comprising control logic to regulate the dispensation of medicating agent by modifying  
         the duty cycle of the valve
49. The apparatus of claim 1 further comprising control logic to regulate deliver of said  
10       medicating agent based on a pleiotrophic nature of said medicating agent.
50. The apparatus of claim 1 further comprising control logic to schedule delivery of said  
         medicating agent based on toxicity and to allow for measures such as bioavailability,  
         solubility, concentration, and circulation based on locality
- 15       51. The apparatus of claim 1 wherein said medicating agent comprises biomodulators.
52. The apparatus of claim 1 comprising control logic to deliver said medicating agent based  
         on individual difference of different tumors.
- 20       53. The apparatus of claim 1 further supports the ability of the apparatus to mitigate the  
         known factors such as peak serum concentration
54. The apparatus of claim 1 further configured to evaluate the effectiveness of the  
25       medicating agent used during animal and clinical studies by providing the details and  
         feedback on the use, dose, cycle, circadian time effects and the entire pharmacokinetic,  
         as well as pharmacodynamic behavior of the medicating agents.
55. The apparatus of claim 1 further configured to be implanted in the neighborhood of the  
30       tumor site for effective local delivery of the medicating agents
56. The apparatus of claim 1 further configured to provide a local administration of BRMs  
         and chemotherapeutic agents to enhance mechanisms that support overlapping effects in  
         reducing tumor burden and elimination of tumors.
- 35

- 5        57. The apparatus of claim 1 comprising a plurality of medicating agents for combination therapy, using one or more biological response modifiers to modify the relationship between tumor and host, hence modifying the host's biological response to tumor cells and chemotherapeutic agents.
- 10       58. The apparatus of claim 1, further comprising control logic to deliver said medicating agent by modulating the pharmacokinetics of the medicating agent as key enzymes, attenuation of drug resistance mechanisms, and modifications in permeability of the vascular system which allow increased accumulation of chemotherapeutic drugs at the tumor site, causing reduction of tumor burden.
- 15       59. The apparatus of claim 1 further supports the use of such modality to improve anti-tumor response and to increase production of cytokines, thereby decreasing suppressor mechanisms
- 20       60. The apparatus of claim 1 comprising control logic to supports modalities of a patient's tolerance to cytotoxic effects.
- 25       61. The apparatus of claim 1 further comprising a software module to control said piezoelectric pump to provide an apparatus to provide a dose and timeline to produce tumor burden elimination or reduction.
62.     The apparatus of claim 1, wherein said pouch is biodegradable.
63.     The apparatus of Claim 1, said pouch comprising an architecture supported by a  
30       scaffolding comprising collagen, said collagen forming a matrix capable of time degradation.
64.     The apparatus of Claim 1, further comprising a synthetic skin substantially enclosing said pouch.